COLORED GLASS ABSORBING ULTRAVIOLET AND INFRARED RAYS

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Abstract of **JP10297934**

PROBLEM TO BE SOLVED: To obtain a colored glass composition absorbing ultraviolet and infrared rays enabling mutual exchange of a clear glass and the colored glass absorbing the ultraviolet and infrared rays to be rapidly carried out and capable of forming a high quality glass without largely changing the conditions for operating the furnace and making a board by using a clear soda ash glass composition as a base, regulating the total of coloring components so as to be within a specific range and allowing the composition to have various properties resembling to that of the clear glass. SOLUTION: This colored glass absorbing ultraviolet and infrared rays is obtained by using a base composition comprising 71.1-71.5 wt.% SiO_2, 1.6-1.9 wt.% Al_2O_3, 3.2-3.5 wt.% MgO, 6.9-7.2 wt.% CaO, 12.8-13.3 wt.% Na_2O, 0.6-0.9 wt.% K_2O and 0.05-0.2 wt.% SO_3, and formulating Fe_2O_3 (whole iron), and CeO_2 and/or TiO_2 as coloring components and regulating the total of the coloring components so as to be 2.0-3.0 wt.%. The glass preferably has 2.50-2.52 specific gravity, 1440± 10 deg.C temperature at log &eta (poise)=2, and 515± 10 deg.C temperature at the strain point.

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ULTRAVIOLET AND INFRARED RAY ABSORBING COLORED GLASS

[Claims]

[Claim 1] An ultraviolet and infrared ray absorbing colored glass that is composed of SiO_2 71.1 to 71.5 wt.%, Al_2O_3 1.6 to 1.9 wt.%, MgO 3.2 to 3.5 wt.%, CaO 6.9 to 7.2 wt.%, Na_2O 12.8 to 13.3 wt.%, K_2O 0.6 to 0.9 wt.%, and SO_3 0.05 to 0.2 wt.%, and contains at least Fe_2O_3 (total iron), and CeO_2 and/or TiO_2 as coloring components, wherein a sum of contents of the coloring components is 2.0 to 3.0 wt.%.

[Claim 2] The ultraviolet and infrared ray absorbing colored glass according to claim 1, wherein a specific gravity of the glass is 2.50 to 2.52.

[Claim 3] The ultraviolet and infrared ray absorbing colored glass according to claim 1 or 2, wherein in a glass viscosity-temperature relationship, a temperature when $\log\eta$ (poise) = 2 is satisfied is 1440±10°C, and a temperature at a strain point is 515±10°C.

[Claim 4] The ultraviolet and infrared ray absorbing colored glass according to claim 1, 2, 3, or 4, wherein when the glass is 4 mm in thickness, an ultraviolet ray transmittance is 10% or less, a visible light transmittance is 65% or higher, and a solar radiation transmittance is 45% or less, measured with illuminant A.

[0016] As coloring components for the ultraviolet and infrared ray absorbing colored glass, the glass contains at least Fe_2O_3 (total iron) that absorbs an infrared region and CeO_2 and/or TiO_2 that absorb an ultraviolet region. The sum of the coloring components is in a range of 2.0 to 3.0 wt.%. In order to exhibit the above-described effect, among the above components, it is needed that the content of Fe_2O_3 (total iron) is 0.5 wt.% or more, and CeO_2 and/or TiO_2 is 1.5 wt.% or more. Regarding CeO_2 and TiO_2, it is preferable that CeO_2 that tends to vary an iron-ion ratio and yet can sharply shield the ultraviolet region is primary used, and TiO_2 that absorbs from the ultraviolet region to a low wavelength region of the visible light and yet does not affect the rate of reduction is secondarily used.

[0017] In order to adjust the color tone, the contents of the above-described components are appropriately increased. Furthermore, MnO, CoO, Cr_2O_3, and the like in a content of several ppm to several hundred of ppm may be

appropriately introduced. It should be noted that when the total content of the coloring components exceeds 3.0 wt.%, the visible light transmittance of the product decreases, and it becomes difficult to obtain an operation condition similar to a condition for operating a furnace and manufacturing a plate of the clear glass. Therefore, the total content should not exceed this level.

[0023] According to the present invention, the glass ranges from a thin flat glass of about 1 mm in plate thickness to a thick flat glass of above 10 mm in plate thickness, and it is possible to easily produce from an untreated glass plate a half-tempered glass, a tempered glass or the like as a flat plate glass or a curved plate glass. It is also possible to preferably use as a single-plate glass, a laminated glass, an insulating glass or the like for an architectural window material, and a transport-use window material, in particular, for an automotive windowpane.

[0025] <u>Example 1</u>

As glass raw materials, silica sand, feldspar, soda ash, dolomite, limestone, mirabilite, colcothar, titanium oxide, cerium carbonate, carbon, and a coloring component concentrated frit were appropriately adopted. These components were combined at a desired ratio. The prepared raw material was placed in a melting pot, and melted in an electric furnace that was kept at about 1450°C, which is an equal temperature to that of a real furnace (for example, a lateral side wall portion in the vicinity of an injection port) for about 3 to 4 hours so as to vitrify. Furthermore, in order to homogenize and clarify the glass, the glass was kept at 1420 to 1430°C for about 1.5 to 2 hours, and subsequently, charged into a mold so that a glass block was formed. The resultant glass block was cut into a plate shape and then ground and polished, or reworked into a rod shape or a thin line shape, whereby each measurement sample was obtained.

[0026] Regarding these samples, the composition of the glass component (weight %) was determined by an analysis method based on JIS R-3101. As optical properties (at a thickness of 4 mm), a visible light (wavelength: 380 to 780 nm) transmittance (%:measured with illuminant A), an ultraviolet ray (wavelength: 297.5 to 377.5 nm) transmittance (%:measured with illuminant A), and a solar radiation (wavelength: 340 to 1800 nm) transmittance

(%:measured with illuminant A), a dominant wavelength (nm: measured with illuminant D_{65}), an excitation purity (%: measured with illuminant D_{65}) were examined based on JIS Z-8722, JIS R-3106, and ISO/DIS-9050 with a 340-type UV-Visible Spectrophotometer (manufactured by Hitachi, Ltd.) so that each value was calculated. Regarding a viscosity-temperature (°C) relationship, a rising-sphere method was used for a high temperature range and a bending-arm method was used for a low temperature range so that a viscosity curve was evaluated, whereby the temperatures at which the viscosities were 10^2 and 10^{12} poise were calculated. A strain point was measured by a Lillie method, and a softening point was measured by a Littleton method.

[0027] In addition, a linear coefficient of expansion and a glass transition temperature were evaluated with a thermal dilatometer. A density was evaluated by the Archimedes method. A water resistance was evaluated based on JIS R 3502. As a result, the analytical values and the measurement values shown in Tables 1 and 2 were obtained.

[0028] Example 2

The glass raw material and the frit that were the same as those of the Example 1 were used, weighed and combined so that the desired component composition was obtained. A melting operation was then performed, and the resultant glasses were similarly provided for the samples.

[0029] The samples were analyzed, measured, and evaluated as in the case of the Example 1 so that the analytical values and the measurement values shown in Tables 1 and 2 were obtained.

Example 3

The glass raw material and the frit that were the same as those of the Example 1 were used, weighed and combined so that the desired component composition was obtained. A melting operation was then performed, and the resultant glasses were similarly provided for the samples.

[0030] The samples were analyzed, measured, and evaluated as in the case of the Example 1 so that the analytical values and the measurement values shown in Tables 1 and 2 were obtained.

[Table 1] Glass composition (wt.%)

	Example 1	Example 2	Example 3
SiO_2	71.3	71.2	71.2
Al_2O_3	1.72	1.72	1.90
MgO	3.31	3.37	3.38
CaO	7.03	7.04	7.01
Na_2O	13.1	13.2	12.9
K_2O	0.84	0.84	0.69
SO_3	0.07	0.11	0.09
Total Fe_2O_3	0.611	0.749	0.631
FeO	0.198	0.179	0.143
CeO_2	1.61	1.40	1.71
TiO_2	0.39	0.19	0.41
CoO (ppm)	0.0	0.0	0.3
Fe^{2+}/Fe^{3+}	0.56	0.36	0.34
Introduced amount of carbon	0.17*	0.16*	0.17*
Introduced amount of mirabilite ***	0.5	0.5	0.5

* Ratio relative to introduced amount in glass (wt.%)

*** Ratio relative to silica (SiO_2) (wt.%)

[Table 2] Optical properties and other physical and chemical properties

	Example 1**	Example 2**	Example 3**
Optical properties			
Ultraviolet ray transmittance	7.9	8.4	8.1
Visible light transmittance	74.7	74.5	69.0
Solar radiation transmittance	44.4	46.2	34.2
Dominant wavelength	515.6	524.6	500.1
Excitation purity	2.6	2.6	5.5
Color tone	Greenish	Greenish	Greenish
Thermal propreties			
Linear coefficient of expansion	84.3	85.3	84.3
Transition temperature(Tg °C)	553	552	556
Softening point T_{soft} °C)	741	737	747
Annealing point (T_{ann} °C)	557	555	563
Strain point (T_{str} °C)	519	512	520
Viscosity-temperature			
Logη=2	1440	1430	1437
Logη=4	1034	1030	1042
Logη=5	919	912	928
Logη=7	766	760	775
Logη=9	669	664	677
Other physical and chemical properties			
Density (D g/cc)	2.518	2.516	2.517
Water resistance ($mgNa_2O/Dg$)	0.42	0.44	0.39

** 4 mm thick